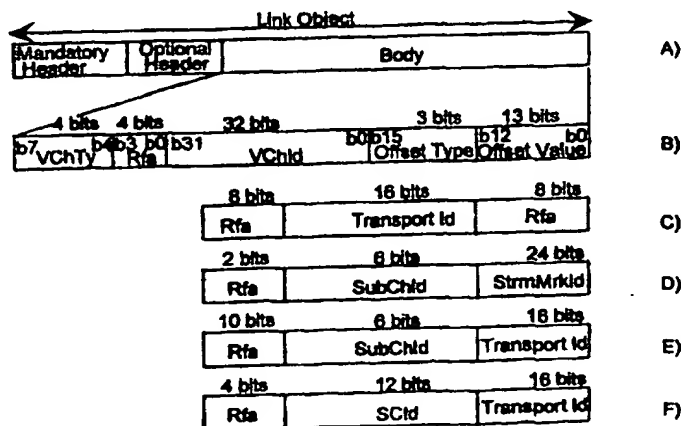




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(54) Title: UTILIZATION OF A LINK OBJECT IN A DIGITAL BROADCASTING SYSTEM



(57) Abstract

In the DAB system, specific link objects enable a useful way of referring to multimedia objects needed in a multimedia session. The virtual channel field (VChId) included in the link object indicates the transport identifier (Transport Id) which identifies on which of the logical channels included in the subchannel the referred target object is transferred, and a subchannel identifier (SubChId). It is difficult, however, for a service producer to utilize links as the subchannel identifiers are created by a DAB operator who sets up the multiplex. The invention shows a method which enables the use of link objects without having exact knowledge where the targeted multimedia object is to be found in the DAB multiplex. The contents of the link objects are defined in such a manner that as the service producer does not know the subchannel identifier (SubChId), this identifier is not used at all in the reference but this target is referred to relatively by using what the receiver is assumed to know already. Therefore in the virtual channel identifier field (VChId) a channel field is placed where a channel identifier and a component quality description can be given. The packet address and the service identifier, when necessary, can also be indicated.

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UTILIZATION OF A LINK OBJECT IN A DIGITAL BROADCASTING SYSTEM

FIELD OF THE INVENTION

The present invention relates to transfer of multimedia objects in a digital broadcasting system which enables transmission of audio and data services and selective reception of these services and especially a linking mechanism of multimedia objects in a radio channel.

BACKGROUND OF THE INVENTION

A digital radio system DAB (Digital Audio Broadcasting) developed for the effective use of frequency bands defines a digital radio channel based on multiple carriers applicable for sending both audio and data services. A transmission channel may either be a continuous data stream or packet channel. The transmission, transfer and reception in the DAB system is explained in detail in ETSI (European Telecommunication Standards Institute) standard ETS 300 401, February 1995.

In the DAB system, the uppermost level of hierarchy, ensemble, contains all the services provided within one specific frequency band. The ensemble is divided into services that may be further divided into service components. A service component is either an audio channel or a data channel. A transmission frame on the lowest level comprises three parts which are temporally successive. The first one is a synchronization channel which contains no service information.

The next one is a fast information channel FIC of a mode-specific fixed length. It contains general information SI (Service Information) relating to audio and data services, which information enables a user to select a desired service, and a multiplex configuration information MCI, that is, information about the number, size and frame position of subchannels. Both SI and MCI information is transferred in so-called fast information groups FIG of which there are various types. One such group defines basic services and service components in the multiplex. The group contains a dedicated field for each service which informs the type of the service, the number of service components, subchannel identification SubChId of audio and data stream components and service component identification SCId if it concerns a data packet channel. Up to 12 service components can be defined for each service.

The last part is MSC (Main Service Channel) which contains all the subchannels. The position, size and number of subchannels inside the MSC

can vary, but the size of the MSC is however fixed. The MSC contains at most 63 different audio and/or data subchannels. The subchannels are numbered on the basis of a so-called Subchannel ID from 0 to 62. The MSC may also have an auxiliary information channel AIC whose channel number is fixed to 5 63. The AIC may contain the same kind of information as FIC.

In the DAB system, data is sent in packets whose data fields are combined to form a so-called Data Group in the receiver. The data field of a data group is a segment of a data file to be transferred.

A continuous audio stream is formed of audio bits placed in an 10 audio field of successive audio frames. The audio information of the frame corresponds to 24 ms of audio. There are at the end of the audio frame X-PAD (extended PAD) and F-PAD (fixed PAD) fields which carry data associated with programme (Programme Associated Data, PAD). This data is in sync with the audio of the frame. The PAD bytes of successive frames form a so-called 15 PAD channel on which lyrics for songs sent in the audio stream, for example, can be transmitted or the channel can be used for a slow file transfer.

The audio portion of a multimedia transmission is meant to be transmitted in audio frames but there may, however, be some reasons for sending audio also in a packet mode. It could in principle be possible to send 20 audio files, for example, in packets, which files would be first stored in the memory of the receiver and repeated over loudspeakers temporally at the correct time during a multimedia presentation.

A specific multimedia object transfer protocol MOT has been suggested for the DAB system. The suggested protocol enables the utilization 25 of all data channels in the transfer of different objects, that is, the use of a PAD channel, a packet channel, a stream channel, and both FIDC and AIC channels. An object is formed of three parts: a mandatory header that contains all the necessary information for transferring the object through the DAB channel, an optional header and a body containing data of the file to be transferred. The objects may be multimedia objects, presentable stream 30 objects or link objects.

Files containing MHEG objects, JPEG images, ASCII text and MPEG video or audio sequences are multimedia objects. These objects have a finite length which is usually known before the transmission is started. An 35 object may have a specific purpose in a multimedia session: it may contain a) content information to be presented to the user, b) information needed for

presenting the content information, or c) information relating to transfer of content or control information. The data in the body of the object can thus be presentable information, that is, visible or audible to the receiver, control information or it may contain another object.

- 5 A presentable stream object is a finite and continuous stream that contains presentable information. If the stream has any internal structure, the structure is visible to the application program only.

10 A link object is a specific multimedia object the purpose of which is to control the transmission of content or control information. A link object binds itself to some other multimedia object or to a presentable stream object. A link object may thus be inside the multimedia object in which case it is transmitted on the same channel as the multimedia object and it causes a transfer to the target of the link in a multimedia session, or it may follow some multimedia object on the same channel, after the presentation of which a transfer occurs
15 to the target of the link.

 The use of the link object is illustrated in Figure 1. Each service S1,...Sm consists of one or more service components, for example in the figure service S2 consists of service components SC3, SC4 and SC5. Various multimedia objects are transmitted with service components, the objects being
20 indicated generally by a hatched area. A specific service may use a multimedia object to be sent with a service component of another service, that is, specific multimedia objects sending with the service component SC2 of service S1 may be included in the multimedia program of the service component SCm of service Sk. The multimedia object has a specific starting
25 point, duration and end point. In addition to multimedia objects, the service component may also transfer link objects (as the service component SC2 in Figure 1). It is also possible that the service component is formed of link objects only, in which case it can be referred to as a link component channel (as the service component SCm in Figure 1). When the receiver receives a
30 multimedia service, it receives and decodes link components at the same time from a service component transmitting link components. It decodes the contents of the link object and after the time indicated in the link object, starts the reception of a multimedia object from another service component which is indicated in the link object.

- 35 Link objects, just as other objects, have a mandatory header, an optional header and a body.

A mandatory header refers to the link object itself and contains information, for example, on that it is a link object.

An optional header contains a reference to the target of the link. It can be used as a header in a target where a header cannot be used in transfer. This target is information transferred in the stream mode, typically audio stream. The optional header of the link object contains the necessary identification data of audio stream, on the basis of which the stream can be separated starting from a desired point from the DAB multiplex. This is a good indication of the use of a link because as the audio stream is a continuous stream, it does not have a header and the normal file transfer mechanism could not therefore be used for transferring it. The header is transferred in an optional header of a separate link object, in which case audio stream or some of it could be used by using normal file transfer mechanisms of the DAB system where the header is essential. A link object can also be used in such a manner that they are sent in advance before the transmission of a multimedia object and on the same channel as a multimedia object. The optional header of the link object informs of the multimedia object coming to the receiver.

A body of the link object contains at least the following fields illustrated in Figure 2

- virtual channel type VchTy whose numerical value indicates the target of the link: a) value 0000 indicates the target is the same component as the link, b) value 0001 indicates the target is audio stream, c) value 0010 indicates the target is part of audio stream X-PAD, and d) value 0011 indicates the target is a packet component,
- virtual channel identifier (VChId) whose contents depend on the type of the virtual channel. It contains in the above-mentioned case (a) a Transport ID valid during transfer, in the audio stream case (b) an audio channel subchannel ID SubCh Id, in case (c) both the subchannel identifier and transport identifier, and in the end in the packet component case (d) a service component identifier SCId. It should be noted that in the case of audio stream there is no Transport ID, but a so-called stream marker in its place that can be used to mark desired points in the audio stream. The term "virtual" is used to emphasize the fact that several logical channels separated from one another by Transport ID's mentioned above are transmitted on the same physical channel. For this reason, there cannot be two similar Transport ID's during file transfer and when the file is divided into segments, each segment

has the same identifier. In the figure, field Rfa refers to values that have not so far been defined and field offset value to the time that will have to be spent after the link object has arrived there until the target object will arrive.

Some problems will be caused if links included in the multimedia program are sent in accordance with the procedure described above on the same channel as multimedia objects, that is, the channel transferring a service component contains links referring to the service component transferred on this channel and on some other channel. Although the link objects as such enable a useful way of referring to the desired target and although in principle a service provider can utilize links if the service provider knows what the service component identifier SC Id of the object to be transferred is and on which subchannel the service component in question is transferred, that is, which is the subchannel identifier Sub Chld, in practice it is difficult for a service provider to utilize links. This is because these identifiers are produced by a DAB operator setting up the DAB multiplex possibly just before the transmission, in which case only the operator can utilize the link objects efficiently. Another problem is related to the case that a service producer would like to use common service components, that is, components that are common with other services or even with services of other service producers.

The latter problem can be attempted to be solved in the scope of known DAB specification by utilizing fast information groups FIG sending on the FIC channel. When the position of the service components of each service is defined in the multiplex, the component common with some other service can be defined for the service in this way. This is only half a solution as both the subchannel identifier and the service identifier have to be known.

The object of the present invention is to provide a mechanism which will enable the use of link objects without having exact information on where the target object can be found in the DAB multiplex.

The presented mechanism is characterized by what is stated in the independent claims.

A service component containing multimedia objects and link objects or merely link objects is provided first. A receiver receiving multimedia program separates from the DAB multiplex a subchannel associated with the program on which subchannel multimedia objects and link objects or merely link objects included in the program are sent. The receiver decodes each link object and retrieves the corresponding target in the DAB multiplex.

The contents of link objects are defined in such a manner that as a service producer does not know the subchannel identifier SubChId, this identifier is not used in the reference. According to the invention, a relative reference is made to the target by utilizing what the receiver is assumed to know already.

The invention will now be explained in more detail in connection with preferred embodiments, with reference to the appended drawings in which

Figure 1 shows the use of a link object;

Figure 2 shows the structure of the link object in a prior art solution;

Figure 3 shows the possible fields of a link object in three basic cases; and

Figure 4 shows the possible fields of a link object in nine other basic cases.

The fields of the link object shown in Figure 3a are the same as in Figure 2a. The body of the object shown in Figure 3b contains, as in the known body of Figure 2b, a virtual channel identifier VChId and an offset field. They differ in the lengths of the fields as in the object structure of the invention, the length of a virtual channel field VChId can be 16, 24, 32, 40, 56 or 72 bits instead of the field of fixed 32 bits, as shown in Figure 2b. The varying field length enables the presentation of the subject matter of the invention, as will be explained later, and a reduced use of stuffing bits Rfa.

In case the virtual channel type VChTy indicates that the target is in the same service component as where the link object is transferred, the field VChId contains a Transport Id as in the known method of Figure 2c.

When the virtual channel type VChTy indicates the target object is audio stream, 4 different cases can be distinguished:

- i. the target is in the same service and on the same subchannel as the link object, Figure 3d,
- ii. the target is in the same service as the link object, Figure 3e,
- iii. the target is in a different service from the link object, Figure 4a,
- iv. the target is in a different service from the link object, Figure 4b.

In the prior art solution of Figure 2d, it is sufficient only to give the subchannel identifier SubChId as it and the Transport Id together define unambiguously the position of the target in the DAB multiplex. The object of the invention is precisely to avoid the use of the subchannel identifier SubChId

as it is not known to the service producer, and this can be done in the manner shown in Figures 3d-e, 4a-b.

When the target containing audio stream is on the same subchannel as the link object, Figure 3d, it is sufficient that only the Transport Id is indicated in the virtual channel identifier VChId since only data is transferred on the same audio channel in addition to audio bits in the X-PAD field. When the receiver obtains a link object in the X-PAD field, in this case it will know straight away that the audio stream comes on the same stream subchannel.

When the target containing audio stream is in the same service as where the link object is transferred, Figure 3e, the Transport Id is first indicated to identify the audio object when the correct subchannel has been found first. The information given in Channel Field will make finding easier. The Channel Field contains a channel descriptor Chan Descr and a channel identifier Channel Id, Figure 3f. From this information the receiver is able to start looking for the target in the multiplex. It is known that the fast information channel FIC will give information on whether only a primary component or secondary components in addition to it belong to the service components. In the descriptor field it is only possible to indicate the primary and secondary component if there is only one secondary component in the services. If there are more than one secondary component in the services, it is necessary to give as the channel identifier the subchannel identifier SubChId in which the component is transferred, Figure 3i. This is a compulsory concession to the object of the invention which will avoid the use of the subchannel identifier.

The case where the target of the link is audio stream in the same service was discussed above with reference to Figures 3e-3i. By means of the channel field in the link object, which is one of the four possible ones, Figures 3d-3e, the receiver can locate on which audio channel the audio service is sent and on the basis of the Transport Id in the object, the receiver can pick the audio stream in question from the subchannel.

When the virtual channel type VChTy, Figure 3b, indicates the target object is audio stream which is sent in a different service from where the received link object has been sent, this is indicated to the receiver by a specific content of the virtual channel identifier VChId, Figures 4a and 4b. The first subfield of the identifier field indicates the service identifier SId (Service Id) from which the target object should be retrieved. The service identifier may

have 16 bits, Figure 4a, or 32 bits, Figure 4b, in which case it may be agreed that the identifier with 16 bits refers to a program service and the identifier with 32 bits refers to a data service. In the subfield Channel Field after it is indicated in the similar way as in the case of Figures 3f-3i on which
5 subchannel the audio service or service component is sent and in the end on the basis of the information in the Transport Id field the receiver is able to pick this audio stream from the subchannel.

Figures 3d-3i and 4a-4b described above illustrate the coding of the virtual channel identifier field VChId in the link object in different cases
10 when the target object is audio stream. It is known to transfer data in the X-PAD field of the frame as well. With reference to Figures 4c-4e, the coding of the identifier field is explained in the following in a case where the target object is sent in the X-PAD field of the audio frame.

When the link object field VChTy indicates the target object is in the
15 same service, the structure of the virtual channel identifier field VChId, Figure 4c, is the same as when referring to audio stream, Figure 3e. It differs only in that the receiver retrieves the target directly from the X-PAD field of the audio frame and not from the field containing audio bits.

When the link object field VChTy indicates the target object is in the
20 different service, the structure of the virtual channel identifier field VChId is otherwise the same as in Figure 4c, except that a new field SId is added to indicate the service identifier of the service in which the target object is sent. The service identifier may have 16 bits, Figure 4d, or 32 bits, Figure 4e. Correspondingly, the length of the whole virtual channel identifier field VChId
25 is either 40 or 56 bits. The virtual channel identifier field VChId of course contains a subfield Transport Id for the transport identifier. With this information, the receiver is able to retrieve the target object from the X-PAD field of the audio frame of the audio stream of some other service.

In the last case it is examined which subfields the virtual channel
30 identifier field VChId comprises when a packet component is referred to in the link object. In order to find a packet component unambiguously, either subchannel identifier SubChId and Packet Address or Service Component Identifier should be known. The object of the invention is to avoid the use of the subchannel identifier SubChId and in the following Figures 4f-4i it is shown
35 how this can be done.

When the link object field VChTy indicates the target object is a packet component and the packets are transmitted on the same subchannel as on which the link object was received, only the packet address is sufficient for identifying a packet unambiguously in addition to said VChTy information.

- 5 The packet address is always known to the service producer. The virtual channel identifier field VChId is then as in Figure 4f. A transport identifier is in the field as in all the other cases, on the basis of which the first packet is found in the channel packet stream. The stuffing bit field RFA is also needed in order that the total length of the VChId field will be 32 bits.

- 10 When the link object field VChTy indicates the target object is a packet component and the packets are transmitted in the same service but on a different subchannel from where the link object was received, to identify the packet unambiguously it is needed in addition to the information in the fields of Figure 4f a channel Field comprising, as in Figure 3f, a channel descriptor
15 Chan Descr and a channel identifier Channel Id. This information will be received from the DAB multiplex FIC channel. The subfields of Figure 4g are thus indicated in the VChId field and the total length of the field is 40 bits.

- When the link object field VChTy indicates the target object is a packet component and the packets are transmitted on the subchannel of some
20 other service than on which the link object was received, a field indicating the service identifier Sid of the service referred to should be added to the structure of Figure 4g. The field may have 16 bits as in Figure 4h or 32 bits as in Figure 4i.

- The meaning of the fields belonging to the Offset Field part in
25 Figures 3j-3n is as follows:

- OffTy is a 4-bit field indicating the type of the offset from the link object to the target object. Four different bit combinations and thus four types could be mentioned: 1) no offset value is given, bits 0000, 2) the offset value is a frame counter value at the start of the target object, bits 0001, 3) the offset
30 value indicates the number of logical frames from the start of the link object to the start of the target object, bits 0011, and 4) the offset value indicates the number of objects remaining to be transmitted in the service component or in the X-PAD before the start of the target object, bits 0011.

- OffsetValue indicates the distance from the link object to the start of
35 the target object. The distance unit and the structure of the field, Figures 3k-3n, depend on the contents of the OffsetType field. The distance unit may be

the counter value CIFCount counting CIF frames, the number Frame Offset of logical frames to the start of the target object or the number of objects sent in the service component or in the X-PAD transmitting the target object before the start of the target.

- 5 It will be obvious to those skilled in the art that the basic idea of the invention can be realized in various different ways. The invention and its embodiments are thus not restricted to the above examples but they may vary within the scope of the claims.

CLAIMS

1. A method for retrieving a multimedia object from a multiplex in a digital broadcasting system where a transmission frame comprises time multiplexed:

5 a fast information channel (FIC) including the general information of the ensemble relating to audio and data services and multiplex configuration information (MCI) indicating the number, size and position of subchannels, in which case each service has a specified identifier (SId),

subchannels with specified identifiers transmitting multimedia
10 objects,

and in which the targeted multimedia object is referred to in the link object including a virtual channel identifier field (VChId) that indicates a transport identifier (Transport Id) identifying on which of the logical channels included in the subchannel the referred target object is transferred,

15 **characterized** in that the virtual channel identifier field (VChId) also includes a channel field that indicates indirectly the subchannel of the target object.

2. A method according to claim 1, **characterized** in that when the target object is audio stream, which is transmitted in the same
20 service as the link object, the channel field includes a channel descriptor and a channel identifier (Channel Id).

3. A method according to claim 2, **characterized** in that the channel descriptor indicates if the target object is a primary component or a secondary component.

25 4. A method according to claim 1, **characterized** in that when the target object is audio stream, which is transferred in a different service from the link object, the virtual channel identifier field (VChId) is supplement in addition to the channel field by a service identifier field where the individual identifier (SId) of the service in which the audio stream is
30 transferred is indicated.

5. A method according to claim 4, **characterized** in that the channel field includes a channel descriptor indicating if the target object is a primary component of a known service, a single secondary component, or one of several secondary components of the service, whereby a channel identifier
35 (Channel Id) is also given.

6. A method according to claim 1, **characterized** in that when the target object is data (X-PAD) which is transferred in connection with audio stream and in the same service as the link object, the virtual channel identifier field (VChId) comprises only a channel field and a transport identifier.

5 7. A method according to claim 1, **characterized** in that the target object is data (X-PAD) which is transferred in connection with the audio stream and in the different service from the link object, the virtual channel identifier field (VChId) comprises in addition to the channel field and the transport identifier the individual identifier (SId) of the service in which the
10 audio stream is transferred.

8. A method according to claim 1, **characterized** in that when the target object is a packet component which is transferred on the same subchannel as the link object, the virtual channel identifier field (VChId) includes in addition to the transport identifier a field indicating the address of
15 the packets in the packet component.

9. A method according to claim 1, **characterized** in that the target object is a packet component which is transferred on a different subchannel from but in the same service as the link object, the virtual channel identifier field (VChId) includes in addition to the transport identifier and the
20 channel field a field indicating the address of the packets in the packet component.

10. A method according to claim 1, **characterized** in that the target object is a packet component which is transferred on a different subchannel and in a different service from the link object, the virtual channel identifier field (VChId) includes in addition to the transport identifier and the
25 channel field a field indicating the address and the field of the packets in the packet component indicating the service identifier (SId) in which the packet component is transferred.

11. An arrangement for retrieving a multimedia object from a
30 multiplex in a digital broadcasting system where a transmission frame comprises time multiplexed:

a fast information channel (FIC) including the general information of the ensemble relating to audio and data services and multiplex configuration information (MCI) indicating the number, size and position of subchannels, in
35 which case each service has a specified identifier (SId),

subchannels with specified identifiers transmitting multimedia objects,

and in which the targeted multimedia object is referred to in the link object including a virtual channel identifier field (VChId) that indicates a transport identifier (Transport Id) identifying on which of the logical channels
5 included in the subchannel the referred target object is transferred,

characterized in that the virtual channel identifier field (VChId) also includes a channel field that indicates indirectly the subchannel of the target object.

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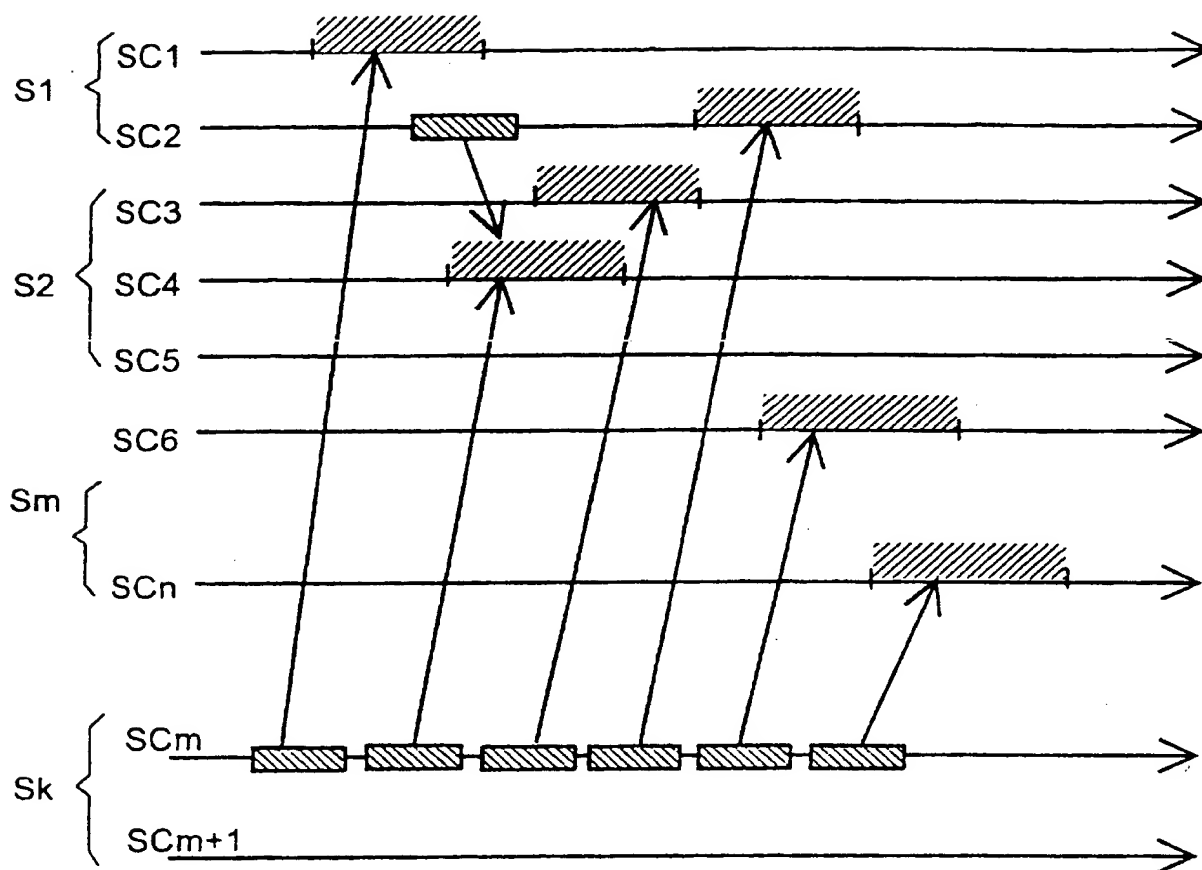


Fig. 1

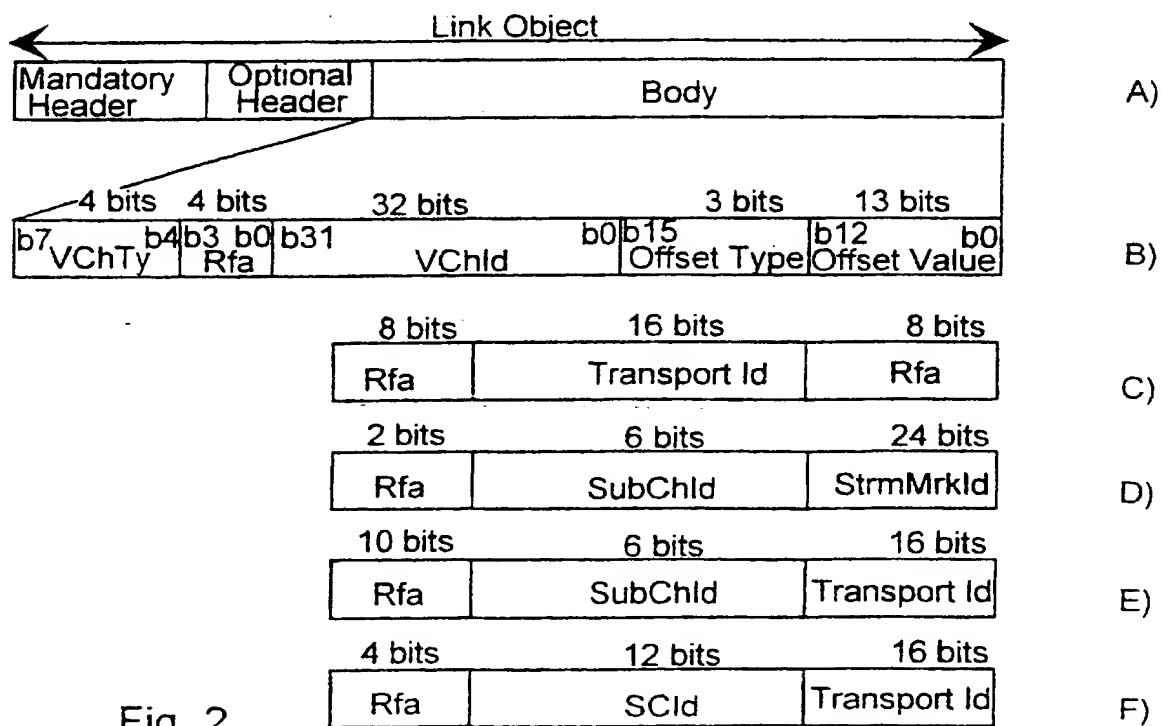


Fig. 2

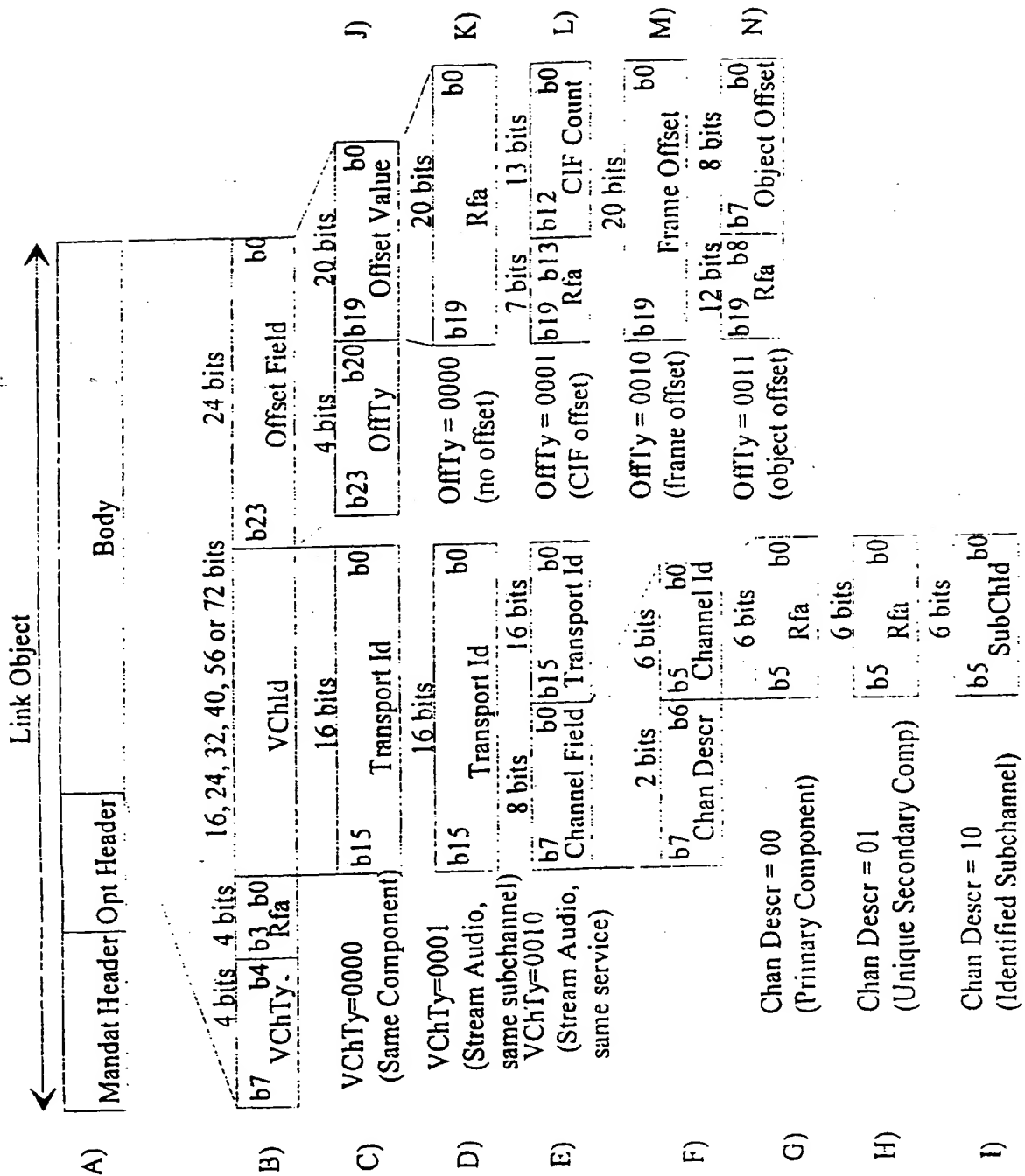
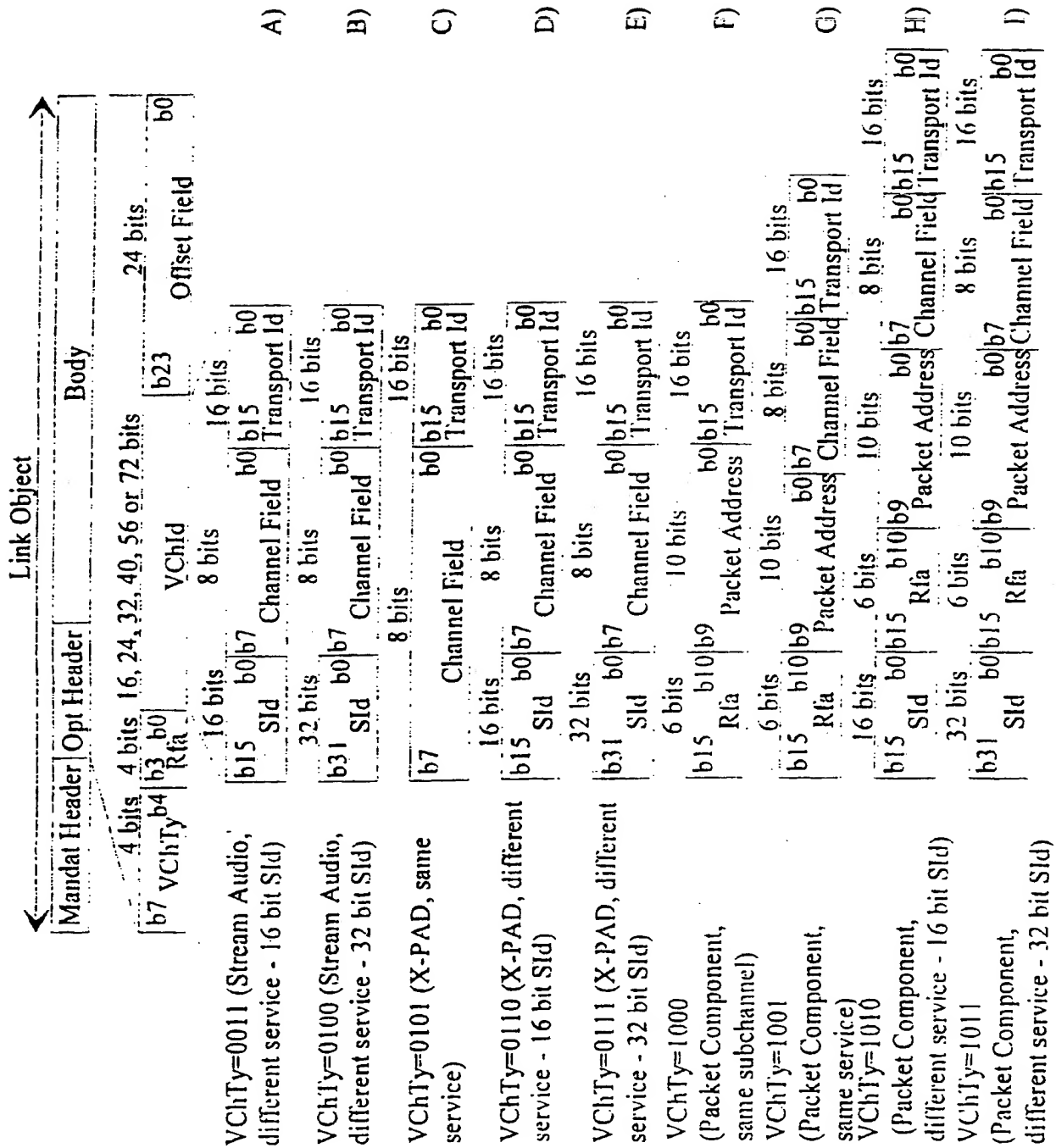


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 97/00278

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04H 1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04H, H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A,P	WO 9713339 A1 (PHILIPS ELECTRONICS N.V. ET AL), 10 April 1997 (10.04.97), page 1, line 28 - page 4, line 23; page 6, line 15 - page 7, line 24, abstract --	1-11
A,P	WO 9713338 A1 (PHILIPS ELECTRONICS N.V. ET AL), 10 April 1997 (10.04.97), page 2, line 4 - page 3, line 10; page 5, line 4 - page 6, line 11, abstract --	1-11
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No.

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Information on patent family members

International application No.

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